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PERIMETRY

The Methods, Means, and Manner of Determining the Size of a Field or Scotoma*

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A PATIENT'S visual acuity is a measure of the functional activity of his macula. The function of the rest of the retina is determined by means of perimetry.

Perimetry consists in the accurate determination of the limits of the areas of the retina that are functioning normally, partially, or not at all. It is purely a subjective test and the success or failure that attends it depends largely on the patient's intelligence and goodwill.

Accuracy is essential. A few minutes therefore should be spent in explaining to the patient exactly what is required of him. This may advantageously be followed by plotting out his blind spot. He will thus begin to understand the nature of the test and to appreciate that even though a thing is in front of him, he cannot necessarily see it. At the same time he will learn to observe the appearance and disappearance of the object.

*This paper was written before the meeting of the Oxford Ophthalmological Congress, so that it is in no sense an answer to the communications read at that meeting.—EDITOR.

In order to attain accuracy all apparatus used should be designed to give consistent results.

Methods of Perimetry

Blackboard method.—The earliest method that approached accuracy consisted in seating a patient in front of a blackboard, instructing him to look fixedly at an obvious white mark—the fixation point—and charting out on the blackboard in chalk the areas in which the patient said he could see the object, or those in which he failed to do so. For this purpose, naturally, only one eye was exposed at a time, and the object was mounted on some dull black handle.

This original method had many objections and many modifications have arisen, each attempting to overcome some difficulty.

Objections to the Blackboard Method

(*a*) *Suggestion.*—The first objection to the blackboard method is that the patient sees the marks on the board and is therefore influenced by suggestion.

No marks, obvious to the patient, should therefore be made. The board may be marked into squares or alternatively into concentric circles with radial lines emanating from the centre.

The position of the point at which the object is lost sight of, or is first seen, is noted in relation to these lines and a similar chart is appropriately marked. In another method the board may be replaced by a black cloth, behind which is placed a piece of paper, and the desired point is marked by pricking the paper through the cloth. Again, black-headed pins, invisible to the patient at the distance at which he is sitting, may be pushed into the cloth, which may conveniently be backed up with thick felt. When the examination is completed, the field or scotomata, so found, may be copied on to an appropriate chart.

(*b*) *Absence of any form of head rest.*—In the original method there was no head or chin rest. It was impossible, therefore, to keep the eye at a constant distance from the board. If the observations are being made at a distance of one or two metres, a variation of a centimetre or so is of slight importance, but at 33 centimetres, the distance employed in many perimeters, such movement would lead to an error of several degrees.

(*c*) *Limited scope.*—Further, the board was found inconvenient in that it only enabled one to examine a limited area of the total field of vision.

Theoretically, of course, the eye under examination should be in the centre of a hemisphere and the object should be moved around on its inner surface. But illumination becomes difficult and it is impossible to watch the patient's eye. Förster therefore devised his

arc perimeter. This instrument overcomes both these difficulties, and it is on similar lines that most modern instruments have been made.

The object was still held on some form of unobtrusive handle and a suitable black background was placed behind the arc so that the patient's attention should not be distracted by any bright object, that would have been hidden by the corresponding blackboard.

Further, some surgeons are reported to wear black gloves and even a black coat.

Recording Mechanisms

Next, recording mechanisms began to be added to the arc perimeter so that the recording might be both more rapid and accurate. In order to accomplish this, the object must be propelled along the arc, mechanically or electrically, a marker situated behind the instrument being moved a corresponding and proportional distance; this marker can be made to mark a chart.

The Object

The machine should be so designed that the object alone is moved. It is not infrequently the case that a large object carrier is employed, so designed that any one of several colours may be shown to the patient, and these in several sizes, usually in squares of 1, 2, 5, 10, 15, and 20 mm. edge.

There are several objections to such an arrangement.

In the *first* place the carrier makes a noise, and the patient unconsciously judges its position by the ear rather than the eye.

Secondly, he not infrequently will tell the surgeon that he sees something moving before he can see the object, particularly when the object is small. Unless great care be exercised, erroneous conclusions are liable to be drawn as to the true size of the field.

Thirdly, the carrier is often so made that when it becomes a little worn by use, the disc carrying the colours may revolve while the carrier is travelling round the arc, thus the colour of the object may change without the surgeon being aware of it.

Lastly, the metal plate in which the notches are cut, exposing varying sizes of the object, not infrequently lies a full millimetre in front of the disc carrying the colours. The light is coming from behind the patient, and therefore as the object carrier is moved around the arc away from the centre, the edge of this disc throws a shadow over the object, which increases as the object carrier proceeds from the centre. The result is that, although the object lies well within the field of vision, it may be entirely invisible to the patient.

Therefore different sizes of object of each colour should be employed, and the carrier should be small, and if possible, out of sight.

Mechanical Accuracy

The instrument should be mechanically accurate. There are difficulties in its construction because of the necessity of carrying the power round the curve of the arc. In the past this has been overcome by using gut, string, wire, or chain. They are all almost equally unsatisfactory. They usually work well when they leave the maker's shop, but soon begin to stretch. This results in the recording mechanism being thrown out of adjustment. The instrument should be made with a positive drive through a rackwork and gear wheels, or the like.

Handle.—The handle whereby the mechanism is operated should be of convenient size. It should be worked by movement of the wrist. Some of the more modern machines have a type of capstan wheel. This is too large to grasp in the hand and it is not easy accurately to move it a small amount. Further, the handle should be mounted at some distance from the recording needle to avoid the possibility of the surgeon scratching his hand.

Silence.—As already mentioned, the machine should work silently.

Chin Rest.—Inaccuracy due to improper adjustment

In the McHardy perimeter, and in certain others which were designed before adjustable tables came into vogue, the chin rest is adjusted to the height that is comfortable to the patient. The centre of the cornea may therefore be above or below the centre of the arc. In order to obviate the error that would thus be introduced, the height of the centre of rotation of the arc is adjustable. Two scales are employed, one on the pillar supporting the chin rest and the other on the column of the arc. A special rod is attached to a sliding member around the scale on the chin rest pillar. Its free end is placed opposite the centre of the cornea, and the position of the other end is read on the scale. The column supporting the arc is adjusted until a similar reading is obtained on its scale. This is a very accurate method, but the special rod has to be detached from the machine while a field is being taken out, and not infrequently becomes mislaid or lost. This results in the adjustment of the height becoming a matter of mere guess work. Incorrect adjustment of this nature may lead to an inaccuracy of as much as 10° above and below, although it has very little influence on the size of the lateral fields.

It is preferable therefore to fix the height of the eye relative to the centre of the arc. This is best attained by employing some type of cheek support. The lower edge of the patient's orbit is placed

against this, and the chin rest raised until it just supports the patient's chin. The height of the table, or the perimeter stand, is then adjusted until the patient is comfortable.

Patient's Comfort.—It is essential that the patient be comfortable; if he is not comfortable, he will not be attentive, and if he is not attentive the results obtained will be useless.

Chart

Size of the chart.—In the McHardy, and in a great many other machines, the 180° movement of the object is represented by 100 millimetres on the chart. Priestley Smith, however, uses a chart 90 mm. wide to represent the 180°, that is half a millimetre for each degree. In practice this is found to be amply large.

If a recording perimeter is not being employed it is immaterial what sized piece of paper is used. When copying from a Bjerrum Screen or an Elliot Scotometer, it is possible that greater accuracy is obtained by using a larger scale, for whereas the prick of a needle may be made accurately to half a millimetre or even less, it is not easy to obtain such accuracy with a pencil or even a pen.

Notation of the chart.—The method of axial angular notation varies on different charts. It seems desirable that the notation employed in mathematics should be employed here. The chart represents the patient's field as he sees it, and therefore the notation should be from his point of view. This is possibly a little unfortunate as the axial notation of cylinders in astigmatism is the mathematical one as the surgeon looks at the patient. But as the two are probably never considered in relation to one another, this is unimportant.

Method of attaching chart to perimeter.—In most perimeters, in order to ensure that the chart is placed accurately in the chart-holder, this latter is provided with a central pin projecting about two millimetres above the general surface of the holder. The central point of the chart is impaled upon this pin. This is not too easy to carry out, and the surgeon has been known to prick his finger.

With modern methods of accurate printing, it is quite easy to print the charts so that the central point is an exact distance from the bottom and one edge of the paper. The chart holder has three adjustable stops, two at the bottom and one at one side. The chart is placed with its edges in contact with these stops, and is held in position by a spring. If there is any doubt about the chart being correctly centred, the object is racked out to the extreme periphery, and the arc swung into the horizontal plane. The position of the object is now marked by pressing the chart against the marker. If the chart is correctly placed, the needle prick will be exactly on the horizontal level on the 90° circle.

Once the stops are adjusted, they will not require to be altered until a new batch of charts is employed, and not necessarily even then.

The principal objection to the central pin in the chart holder is that when the object is racked to the centre the marker, if correctly adjusted, strikes the central pin and is bent to one side. Further, the central pin makes it difficult to renew the linoleum, and this gets worn out near the centre and then it is very difficult accurately to mark out a small scotoma near the fixation point.

Stops on Arc Bearing

It is convenient to have some form of mechanism to indicate to the surgeon when the arc is exactly in the vertical and horizontal positions and at every intervening position 15° apart.

Bjerrum Screen.

Some observers prefer that the patient should be at a greater distance from the object than the 33 centimetres of most perimeters. They work at a distance of a half, or one metre, or even two metres. In general, smaller objects are used and no attempt is made to examine any area other than that of the centre of the field.

The best form of screen to employ is one of black cloth or velvet, on which radial and circular lines are worked in black thread. These are invisible to the patient at the distance at which he is sitting. The radial lines are marked at every 30° and the circular ones at every 10°. The diameter of the circular lines has, naturally, to be calculated for the distance at which the chart has to be used, the circles becoming progressively larger in proportion to the tangent scale.

It is convenient to stretch the screen taut over a frame and to use the head of a white-headed pin as the central object on to which the patient is to fix his gaze. The limits of the patient's field of vision, or of any scotoma, or of his blind spot, determined by using a small object on a long black handle, are marked on the screen by putting in small black-headed pins which are invisible to the patient. The areas so found are transcribed on to a conveniently sized chart.

Such methods are only applicable to the central 30° to 40°.

Elliot's Scotometer

This is virtually a Bjerrum's screen mounted on a circular board which can be rotated around its central point. It is designed to be used at one metre. A radial scale is worked in thread on the front and an axial degree scale is marked on the back. It is more rapid in use than a Bjerrum for the following reasons:

When using the Bjerrum screen, the surgeon first has to

determine the position of the scotoma, plotting it out on the screen with pins. He then has to find the numerical value of this position. For it is only by this means that he is enabled accurately to copy it on to a chart.

With an Elliot, on the other hand, this numeration of the position of the scotoma is operated by the machine. It therefore takes less time to use an Elliot than a Bjerrum.

There are no mechanical difficulties in making an Elliot into a self-recording scotometer. It would be necessary to incorporate a suitably shaped cam to counteract the distortion introduced by the surface being flat instead of being part of the wall of a sphere.

Reasons for popularity of Bjerrum and Elliot methods

1.—*Angular speed of object.* When using either of the methods the object is usually moved by the surgeon, unconsciously, at about the same speed as when using a perimeter. As the distance from the patient is much greater, the angular velocity is proportionately less, and the patient therefore has time to make up his mind when he sees and when he loses sight of the object, and to expostulate. When working close to the patient, as with certain instruments, the angular velocity is very much greater, and the image of the object moves so rapidly across the scotomatous area on the retina, that the patient fails to observe many of the slighter changes.

2.—*Size of object.* In order accurately to determine the exact borders of a scotoma only a very small area of the retina should be stimulated at a time, that is, the angle subtended by the object should be very small, one or two minutes of arc.

It is not convenient to work with an object much smaller than a millimetre or a millimetre and a half in diameter. If the angle that is to be subtended is to be small, the object should be viewed from a distance.

Comparison of Perimeter with Screen or Plane Scotometer

The advantages of the screen or the plane scotometer are twofold.

1. They are less complicated.
2. The instruments are much cheaper.

Their disadvantages compared with a perimeter of sound construction are many.

1. There is a tangential distortion of the field which requires to be corrected when it is transcribed on to a chart.
2. There is a relative decrease in the size of the object as it is moved away from centre. This cannot be corrected.
3. The periphery of the field cannot be examined.

4. They are not self-recording, and therefore are slower to use.

5. They are more cumbersome.

6. But the important advantage of the perimeter is that the surgeon can watch the patient the whole time, to see that he is keeping his eye fixed on the central target. When using a screen the surgeon must be watching the screen to see where he is holding the object, and how he is moving it, and he cannot possibly attend to the patient. With an Elliot, he can watch the patient, but the shape of the instrument makes him stand to one side, and he cannot get as good a view as he can when using the perimeter.

The apparent disadvantages of the perimeter are twofold. In the first place since the object must be viewed from a distance of about 33 centimetres very minute objects cannot be employed.

In the second place, the recording mechanism reduces the size of the blind spot and any scotoma to such a degree (about 11 times) that small changes in the size are not easily detected.

Both these difficulties may easily be overcome, thus adding to the perimeter those advantages hitherto only obtainable with a Bjerrum screen.

Minute Objects

In order to obtain a really small cone of light the object should consist of a suitably sized polished sphere of black glass. The observations are carried out in a dark room and a single light is placed immediately over the patient's head. With the object at 33 centimetres, with an ordinary carbon filament ophthalmoscope (Stern's) lamp, and a spherical surface of 3 mm. radius, the cone of reflected light subtends 1 minute of arc. With a suitable resistance in the lamp circuit, various brightnesses of image may be obtained, and by interposing coloured screens, various colour fields may be plotted out.

Large Scale Chart

As plotted out by the recording mechanism of an ordinary perimeter 1 degree of movement of the object is represented by about half a millimetre on the chart. When plotted out in this scale the blind spot is quite small and it might become enlarged by 1 degree or more before the enlargement would be very obvious. If, however, the scale be 8, 10, or 12 times greater, small variations in size immediately become apparent.

In a perimeter with an arc 33 cm. in radius, the object moves 5·8 mm. in passing through 1 degree.

The blind spot plotted out in this scale would be a convenient size.

Special Chart Holder for Large Scale Chart

In order to record the size of the blind spot or a central scotoma in this large scale a special chart holder is employed. It is curved so as to form part of the surface of a sphere of a slightly lesser radius than the radius of the arc. It is some 30 cm. long and 15 cm. broad. The special chart is held on its convex surface. It is attached by a hinge to an arm which fits on to the chin rest pillar. When not in use, it is easily removed. When in use, the chart holder lies just below and in front of the patient's chin. It is so mounted that the hinge allows it to be swung up against the arc, and it is so adjusted that the centre of the chart comes to lie opposite the fixation point.

The object has a small needle mounted on its surface. Thus when the chart is brought up against the surface of the arc, the exact position of the object is recorded.

The chart represents an area some 52 degrees from side to side and some 26 degrees vertically.

By this means the size of the blind spot, or central scotoma may be recorded rapidly and permanently. In conjunction with the minute reflected object mentioned in the last paragraph as accurate results may be obtained with a perimeter as with a Bjerrum screen or an Elliot scotometer.

Taking the Field when the patient has a Central Scotoma

When the patient has a central scotoma, it is obvious that it is impossible for him to fix the central object. He is therefore instructed to place the tip of his index finger on the target and to look in that direction at the tip of his finger. Usually he can do this with comparative accuracy, so that the limits of his scotoma may be determined with precision.

It may happen, however, that he has some sensory disturbance of his upper limbs, when he will not know exactly where his finger is, and this method will be useless.

Under these circumstances, if he has no scotoma in the other eye, he uses it to fix the target. The test object must be hidden from the fixing eye. This may be accomplished by using a tube down which he looks.

Alternatively a green glass through which the white central target may easily be seen is placed in front of the fixing eye. A red object is used to determine the size of the scotoma. The red object cannot be seen by the fixing eye through the green glass; therefore when it is seen it must be the eye with the central scotoma that sees it.

Both these methods presuppose that the patient has no heterophoria. If he has and the extent is known, the target may be suitably displaced to correct for it.

It must be extremely rare to find a patient who has sensory disturbances of both upper limbs, and a central scotoma of one eye, and the other eye unaffected.

Size of Objects

It is usual to define the size of the object employed in taking out a field by mentioning its width in millimetres. In different machines these objects may be at very different distances from the patient. The important point, obviously, is the angle subtended by the margins of the object.

The sizes of the objects supplied with most perimeters are 1 millimetre, 2, 5, 10, and 20 millimetres. These approximate to 4°, 2°, 1°, 20 minutes and 10 minutes of arc, when employed 33 centimetres from the patient's eye. The largest is too small. The smallest is too large.

White Objects.—The largest should be oblong subtending 10° by 5°. It should be mounted so that it moves along the arc with its wider edge towards the centre.

The others should be square, the edge subtending 4°, 2°, 1°, and 0.2°.

Coloured Objects.—It is usual to employ blue and green, as well as red objects, although red are the ones most frequently used. These objects should be square and subtend 4°, 2°, 1° and 0.2° respectively.

Grey Objects.—Occasionally it will be found useful to be able to test a patient with a grey object, particularly if it is known that he suffers from some form of colour blindness.

Illumination

Within wide limits, reduction in illumination will have only slight, if any, influence on the size of the field for white. With colours, however, it is otherwise, relatively slight reduction causing considerable changes in the sizes of the fields. This is particularly so when working with blue and green in artificial light, for when the illumination is reduced by inserting a resistance, the character of the light varies, red rays being predominant.

It is stated that when using a grey object, if the illumination be of suitable strength, fields can be plotted out that correspond accurately to each of the various colour fields. These observers imply that the stimulus of colour is merely a question of intensity. In view of the work that has been done on the variation of colour fields in cerebral tumours and in hysteria, it would appear that, if the facts are as stated, the explanation, at least, is wrong.

Standard of Illumination

No standard of illumination has been agreed upon. But it is obvious that if the results of different workers are to be comparable,

the conditions under which they work should be alike. Daylight varies in colour and intensity from day to day and hour to hour. The standard should be an artificial one and the examination should be carried out in a darkened room. The lights should be diffuse, three lamps may be conveniently used, one on each side of the patient, and one over his head. Stern's carbon filament ophthalmoscopic lamps are quite suitable, but unfortunately their life is only a few hundred hours, and the longer they have been used the less light they give out, and the more red it becomes.

More recently a new type of artificial daylight has been introduced (Sheringham), and it is possible that if it becomes commercially successful, this lamp might be adopted as a standard if its intensity can be suitably controlled.

Size of the Field

As already mentioned, unless the eye be properly placed opposite the centre of the arc, the field may be made to appear to be contracted above or below, as the case may be. Quite apart from this, when the nasal field is being plotted out, unless the head be turned a little to that side, the nose may cause an apparent contraction of this field.

If a chart be examined it will be observed that the normal field is nearly circular, with the blind spot as the centre, with the exception of the area cut off by the eyebrow. Often in patients with prominent eyes, if the head be tilted backwards, and the surgeon raises the upper lid and eyebrow with his finger and thumb, the upper field may be considerably increased in size, so that the field may almost become circular.

Difference in size of Field for seeing and Field for losing Object

When taking out a field with a 1° object, particularly when there is some obvious contraction, two quite distinct margins may be plotted out.

1. The field as determined by the points at which the patient sees the object when it is being moved from the blind area to the seeing one, i.e., towards the fixation point.
2. The field as determined by the points at which the object is lost sight of when moved into the blind area, i.e., outwards.

The second of these fields is invariably found to be larger than the first. This is denied by certain workers.

Similarly when working out the limits of a central scotoma, the scotoma as determined by moving the object inwards will be found smaller than when working outwards.

With a 1° object and dull illumination there may be as much as 10° difference in the size of these fields. But with an increase in

the size of the object or of its illumination, they more closely approach one another in size.

(This is a psychological phenomenon and is not peculiar to perimetry. If a watch be brought up gradually to the ear till heard, and then withdrawn until no longer heard, it will be found that the second position will be considerably farther from the ear than the first).

It is usual to accept the field where the object is seen as the true field.

Variations in Colour or Intensity of Object

The patient may remark that the object appears to change colour, or pass into a fog as it is moved around the arc. If he does so, the size of the object should be reduced, and, if necessary, the colour changed. In this way a scotoma will quite probably be discovered that otherwise might have passed unnoticed.

Movement of the Object

The speed of movement of the object has considerable influence on the size of the results obtained when examining a field or scotoma.

Under certain conditions of the cortex cerebri, retina, or the intervening tracts, the sensitiveness of the retina to light may be so reduced that it is inappreciative of the light coming from even a large white object if that object be stationary, and is only stimulated by the change from dark to light and vice versa.

When taking out a field, therefore, great care should be taken that the object be moved sufficiently slowly. In such a case, the field taken out with a 10° object may be nearly full. When a 4° object is used a much smaller one will be found, and the field taken out with a 1° object may be quite contracted.

But if the 4° object, or even possibly the 1° object be moved about fairly rapidly in the area that was blind to the slowly moving 4° object, the patient may see it. In the same way the retina blind even to a 10° object may be stimulated by moving that object about rapidly.

No standard of speed has been determined or agreed upon, for the moving of the object, but if scientific accuracy is aimed at it is obvious from the above facts that some speed limit should be observed.

Again, when determining the size of a scotoma, the speed of the object should be quite slow. The object is small, and therefore the stimulation slight, and the patient must be given time to appreciate its presence. It it be moved rapidly, the patient will inevitably fail to observe slight changes in intensity or colour and inaccurate results will be obtained.

Tests to be applied

1. The maximum field as ascertained by using a 10° white object. If the field be found to be contracted when moving slowly, the object is moved backwards and forwards as described above to see if the "field for a moving 10° object" is larger.
2. Field for 1° white object or other sizes.
3. Field for colours.

If these coloured objects subtend 10° or more and are well illuminated, the field obtained with them is nearly, if not quite, as large as that obtained with a 10° white. If, however, they are as small as 1° the fields are markedly smaller. Blue is the largest, then red, green being comparatively small. It is stated that whereas blue and green objects are seen in the periphery before their colour can be named, a red object is seen as red as soon as it can be seen at all. This statement may be correct for certain patients, but it certainly is not universally true.

Method of taking a field

The patient sits at a table with the instrument suitably adjusted. One eye is covered. The 1° white object is used. The perimeter arm is swung into a horizontal or vertical position or into a position 30° to the one side or the other.

The surgeon keeps his attention fixed on the patient's eye, to see that he does not allow it to wander off the fixation point. He starts with the object at the end of the arm and he slowly rotates the handle of the perimeter, racking the object inwards until the patient sees it appearing in the periphery. He should not accept this as being the limit of the field, but should rack the object out a little and repeat the process at least once in each of the first three or four positions of the arc, as it will frequently be found that on the second examination the patient will see the object at a point farther away from the centre. When the surgeon has satisfied himself that he has determined the true limit of the patient's field in this meridian, he presses the chart in the chart-holder gently against the marker, and thus records its extent at this point.

He next proceeds to rack the object slowly up to the fixation point, asking the patient to observe if it remains visible all the way, or if it appears to change, no matter how slightly, in colour or brightness. If the object is seen all the way, the surgeon turns the arc through 30° (i.e., 2 clicks of the machine), racks the object out to the extreme periphery, and repeats the process.

If, however, while being moved towards the centre the object disappears from view, it is racked back in the reverse direction until it is seen again. The point where the object is lost from view is not marked. As has already been noted, the point where the

object is lost sight of may be anything from 2° to 10° away from the point where it is seen. It is the point where it is seen that is marked.

Having marked this point, the object is once more racked up towards the centre. Since the patient has no central scotoma for white, the object must become visible again at or before it reaches the fixation point.

As has already been mentioned, if the object appears to change in colour or intensity the area over which this occurs is noted, and subsequently carefully searched for a scotoma with a smaller and possibly a coloured object.

If the field is substantially normal in size, it will be unnecessary to make more than these twelve observations.

If, however, the marks do not fall regularly near the limits of the normal field and the field shows an indentation at one point, the limits of vision at this point must be determined carefully. In order to do this the arc is rotated into the meridian of the indentation, and the object is racked to a point some 10° outside the point where it was seen. The arc is now slowly rotated in one direction, and the point where the object is seen is marked. It is then rotated in the reverse direction until the object is again seen and the place marked. The object is now racked another 10° outwards and the arc rotated once more until the limits of the field are accurately determined.

If the field is full when examined with a 1° object, and no alterations in colour or intensity are observed, nothing further remains to be done unless there is some particular indication for looking for a scotoma.

If, however, the field be found to be small, the process is repeated with a 10° object. If the field is not found to be full even when examined by this means, the surgeon moves the object backwards and forwards a degree or so along the arc to see if by this means the periphery of the retina can be stimulated. If it cannot, then the greatest limit of the field is marked. The field next investigated with a 4° and then a 2° white object after whic it is searched for scotomata with a small white object, 0.2°, or even smaller.

Then a 1° red object is employed, and if there are any indications for doing so, a smaller or larger red. Then a blue object, and lastly a green one.

The necessity for, and the importance of, moving the object slowly has already been explained. It is even more important when dealing with coloured objects than with white.

Rotation of the Arc

The method described above of rotating the arc is particularly important in determining the exact limits of a scotoma around the

fixation point, or the margins of a hemianopia and the like. If one merely determines the limits of the field by moving the object radially—in contra-distinction to rotatorily—at, say, intervals of even 15°, one does not obtain accurate results and one cannot plot out hemianopias and fields with deep re-entering angles with certainty.

As at present constructed, it is difficult to employ the Elliot scotometer except by rotating it. The result is that one obtains a very "spikey" diagram. These spikes largely disappear when the same field is worked out on a Bjerrum screen, the angles becoming rounded off as the result of taking further observations to one side and the other of the spike.

In taking a field out with a Bjerrum screen, the object can be moved in any direction. With a perimeter, it can only be moved in two, radially and rotatorily. With an Elliot it can only be rotated.

The most accurate field is most easily taken out with a Bjerrum screen, but with care an equally accurate field can be obtained with a perimeter. It requires great care to produce a chart with an Elliot that does not give the impression that the true scotoma of the disc may not be exactly the shape that is depicted.

Fatigue of Patient

Care should be taken not to fatigue the patient. If fatigued his attention will wander and inaccurate records will result, and the time both of the surgeon and the patient will be wasted.

THE THEORY OF COLOUR VISION

BY

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Concluded from p. 412.

Mr. Parsons now passes to the subject of colour vision.

III.—Colour Names

Mr. Parsons does not seem to have comprehended my view with regard to colour names though he has conceded the point for which I fought for so many years, namely, the use of colour names in a practical test for colour blindness. No one has opposed me more strongly on this point than Mr. Parsons; in fact, in the second edition of his book, 1912, he writes: "The fundamental axiom in

colour testing is that no importance should be attached to the naming of colours." This point has now been universally settled and tests which were previously constructed as non-naming tests have been made into naming tests. The use of colour names in a scientific method of classification is important, but from another aspect. When a man is examined with my spectrometer we have a key to his colour vision. A man, for instance, who has a neutral point in the spectrum is definitely dichromic irrespective of the result of further tests. Though he may try to name different portions of the spectrum he will generally state that there are only two colours. In the same way a trichromic is diagnosed by the description of the spectrum as red, red-green, green, green-violet, and violet. The names given to colours by these men are quite characteristic, and show that in the dichromic there are only two colour sensations, and with the trichromic only three. I have often given demonstrations to show that the colour naming of the colour-blind is not haphazard nor dependent only on luminosity. I have stated before the demonstration that I would give a signal before asking the question to indicate whether the reply to my question would be correct or not. It is obvious that, in making a classification of any kind, this must be done with intelligence and discrimination. Some men are good observers and others are not, but it must not be concluded from this that a good observer has better colour vision than the bad observer.

IV.—Discrimination of Hue

My colour perception spectrometer was designed entirely for the detection and classification of colour-blindness. It is possible that a method may be designed which will enable the normal sighted to distinguish more differences of hue, but all the objections which I have raised to former methods must be eliminated. I gave a demonstration in which the monochromatic divisions of the spectrum were with the aid of a double image prism projected upon a screen at a meeting of the Dutch Association for Science at Groningen. The duplicated monochromatic divisions appeared as large rectangular patches of light upon the screen, the red side of one touching the violet side of the other, but even then with the aid of simultaneous colour contrast no one in the audience was able to say which was the red side and which was the violet side of the monochromatic division shown. If, however, the luminosity of one of the patches were diminished, a difference of hue was at once observable. It should here be pointed out that 1.5 $\mu\mu$ is given by Dr. Watson as the least perceptible difference of hue in the region of the D. lines. The first D. line is 589.6 $\mu\mu$ and the second

589 $\mu\mu$, so that it would require a better discrimination than 1.5 $\mu\mu$ to discriminate between them. When two adjacent portions of spectrum are being compared for the least perceptible difference of hue, the divisions must be of equal luminosity, of equal dispersion (therefore, the prisms should be cut from the same piece of glass), the lenses should be exactly the same, the images must just touch and fall on similar portions of the retina, that is, one must not be on the yellow spot and the other on an adjacent region, the angle should be as nearly as possible the same and white or coloured stray light should not be mixed with one of the divisions. The spectrometer when used with a double image prism fulfils all these conditions.

Mr. Parsons refers to a case of mine, a dichromic, who was examined by Dr. Watson. This was a man to whom I referred as having a sense of luminosity similar to the normal, and numerous other observers have made the same statement with regard to dichromic cases. I examined the man in three ways:—First he made a series of matches which were exactly similar to mine. Secondly, his ratio of red and green was tested with a flicker photometer and was exactly the same as mine. Thirdly, Prof. A. W. Porter and I tested him with spectral green light as to the exact point of disappearance when reduced in luminosity; this was exactly the same as ours. It is, therefore, quite evident that this man did not possess any defect in the luminosity of the green. When I saw him examined by Dr. Watson, I at once saw the defect in the latter's methods, which must vitiate all his results. Dr. Watson combined with the flicker photometer, green and white. Now in the dichromic, green and white are much more similar than in the normal sighted and, therefore, the difference seen by a normal sighted person is not obvious to the dichromic, a striking flicker appearing to the normal sighted when the two have combined to the dichromic. For several years I used the flicker photometer and found it absolutely necessary to compare two colours directly; when there is a defect, as, for instance, shortening of the red end of the spectrum, the change in the ratio is striking. A man may become totally colour blind and yet have no defect in form vision or luminosity. I examined a signalman who became totally colour blind after tetanus and whose form vision was perfect.

Mr. Parsons states that Burch pointed out the fallacies of Professor A. W. Porter's and my experiments on successive contrast. This should have been expressed differently, namely, that Burch found with his own eyes a different result. I have the highest opinion of Burch's work and have no doubt that he saw the phenomenon as described by him, but I have conclusive evidence that others when making observations similar to his did not see as he did. It is probable that his eyes were abnormal and I know

that he damaged them with the strong light that he used. In this way he may have damaged his yellow sensation. All his results are explicable on the assumption that he had only four colour sensations: red, green, blue, and violet. I had one patient, the late Adam Hilger, the spectroscope maker, who became an extreme dichromic with his right eye through prolonged work on the colours of the spectrum with this eye. He saw the spectrum as a white band with a tinge of red at one end of the spectrum and a tinge of violet at the other. His form vision was not affected; in fact he found he could pick out the fine lines of the spectrum much more easily with this eye than the other. There is probably no single set of experiments which has given me more converts than those of Porter's and mine on successive contrast. The experiments extended over months and numerous people were examined, many from other laboratories who were prejudiced by other views. Their observations were taken without bias and agreed with ours. We mentioned in our paper a small amount of stray light simply as a matter of minute accuracy but the results were the same when this was excluded. This is expressly stated in my book. p. 251. It is this stray light, but in much larger quantity, which has caused the results of other observers. For instance, a red with an addition of a small amount of stray light will become more saturated after fatigue to green but not when there is no stray light. On this point Burch agrees with us.

Mr. Parsons alludes to my experiments on the movements of after-images; the facts are quite easy to observe, but I quite agree with him that it is extremely unlikely that the movement of the head actually moves the fluid by gravity. I believe that this is done by the accompanying movements of the muscles of the eye expressing the fluid in different directions. This view is supported by the fact that a blue-green after-image may go right through a red one. The movement, however, appears to correspond to the direction of movement. For instance, repeating this a few days ago with a round positive after-image, on moving my head sharply downwards the after-image appeared to move upwards and split into two portions, a distorted semi-circle and a split triangle, with an interval between them. On then moving my head sharply to the right a long streak appeared to the left.

Mr. Parsons has alluded to the different varieties of colou blindness which I have described; these are dealt with fully in my book. I have never met with a case of colour blindness which could be explained on the older theories when examined in minute detail. As an example, I will take a case which at first sight appeared one of typical red blindness, that is, a dichromic with a shortening of the red end of the spectrum. This man could make matches with Lord Rayleigh's colour-mixing apparatus, that is,

mixing red and green to match yellow. He not only made the normal equation, but in a series of observations showed less mean deviation than any normal sighted person I have examined. I was a month in Freiburg in order to see von Kries's methods. I told him of this case; his reply was: "Such a case is absolutely impossible; it would upset all our views." As the man happened to be in Freiburg at the time, I took him to von Kries, who examined him. von Kries, after an hour's examination, remarked: "How can you say this man is colour blind; he is absolutely normal." I then suggested that a match should be made between green and a mixture of red and violet. This he did, matching a brilliant purple against green. von Kries then said: "You don't call that much of a match, do you?" His reply was: "Yes I do; it is the best match I have made this morning." von Kries then gave me a letter giving details of the examination, and agreeing with my view. In this case the shortening of the red end of the spectrum only affected colours containing rays from the shortened portion, and therefore the dichromatism could not have been caused by the absence of a red sensation. I have given this case in detail to show that it is absolutely necessary to see facts and methods before forming an opinion.

Mr. Parsons has accused me of adopting Rollet's theory of simultaneous contrast and not acknowledging the source. My theory is totally different from that of Rollet, with which I do not agree, neither can the facts be explained on the Young theory. Inhibition and subtraction are not synonymous terms. I find no evidence of inhibition. The crucial fact, which seems to have been entirely overlooked, is that the colour is subtracted from the so-called inducing colour, as well as from the grey.

In conclusion, what does Mr. Parsons's attack consist of? Simply of statements that so and so obtains results different from Edridge-Green, garnished with superlative adjectives to force his point. The cause of truth is not advanced by refusing to look at facts. Why is it that every other review of my book is so favourable when Mr. Parsons has not a good word to say of any portion of it? Let any reader compare the reviews in the *Philosophical Magazine*, *Nature*, or the *Revue générale des Sciences*, Paris. Professor Dufour, the writer of the last-named review, states: "Cette manière de voir se trouve en accord complet avec tous les faits connus de la vision des couleurs, et elle a permis à M. Edridge-Green de prévoir des faits nouveaux qui n'étaient pas connus à l'époque où il édifiait cette théorie."

THE INFLUENCE OF AGE UPON THE AXIS OF ASTIGMATISM

BY

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ATLANTA, GEORGIA.

FOR some years an impression has been growing upon the writer that there exists a definite relationship between age and the axis of astigmatism. This impression, which gradually grew into a conviction, was that the "rule" which says that the axis in hypermetropic astigmatism tends to be vertical, while correct for young people, is the reverse of correct for the elderly, and that therefore in middle age the axis takes a middle course. How completely this conviction is supported by the facts will appear in this paper. It is possible that this question has already arisen, and been examined and settled, but if so the fact has escaped the writer's notice, while a friend who recently was resident for three years in the New York Eye and Ear Infirmary, in which certain of the surgeons pay much attention to refraction, states that the conclusions which follow are entirely new to him.

About the year 1894, the writer, on a number of occasions, watched his friend, the late Dr. George Bull, in his consulting rooms in Paris at work on refraction cases, in which he took much interest. He was greatly occupied with the various causes of blurred vision, among them, of course, astigmatism; and I remember that he laid particular stress upon the influence of the "clignement" of the lids in producing at least temporary astigmatism, which would naturally be according to the "rule." He afterwards published two or three papers on this subject,* which I believe were well received by ophthalmologists. For instance, Parsons† says: "Perhaps the pressure of the lids on the globe tends to squeeze it above and below." The prolonged influence of lid pressure, if any—and the writer has always been sceptical in this regard—one would expect, however, to increase the astigmatism "with the rule," and even if the pressure may possibly diminish with age, that occurrence would hardly account for a change to astigmatism "against the rule."

To test the question the writer considered that the fairest method would be to take old cases as they came in his card system, using no diseased eyes, and to record them in tabular form. He began

*"Lid pressure on the cornea." *Trans. Intern. Oph. Congress*, Edinburgh, 1894, p. 107; and "Visual effects of refractive error," *Trans. Ophthal. Soc. of U.K.*, 1896, Vol. XVI. p. 200.

†"Diseases of the Eye," p. 52.

strictly according to that rule, but later modified it to this extent: he decided that one is more liable to error with the small degrees of astigmatism, and after having recorded a number of eyes with ·25D. and ·37D., he passed cases of these amounts, and noted only ·50D. and over. Later, as his time was limited, he decided to pass all ages between 20 and 50, of which he had already included a considerable number, and rather to stress the contrast between the astigmatism of the eyes under 20 with those over 50 years old. Except for these particulars, cases were recorded as they came in the cards.

It was at first intended to record a large number of cases, but as the task was somewhat wearisome, and could be done only at intervals, it was decided to stop, at least for the present, at 100 cases, or 200 eyes. The results, however, seem to be so clear and distinct, so far at least as the *plus* cases are concerned, that they will suffice for the purpose of bringing the subject forward for consideration by others. The myopic cases, only 23 in number, are too few to indicate anything definitely, but they may be taken up at a later date. The method pursued in the investigation was to mark on tables of ruled paper the number of the case, the age in decades, the amount and kind of the astigmatism, and the axis. The exact degree of the axis was not recorded, but the test frame was divided into sections of 15 degrees each, while the vertical axis (90 degrees) and the horizontal axis (180 degrees) had each a separate column. It was simpler to use a test frame in which the figures beginning on each side at the nose increased downwards to 90 and then upwards on the temporal side to 180, like the old English frame, and similar to the American in the left eye, but differing in the right. Four tables were employed: (a) Right eye with cycloplegic; (b) Left eye with cycloplegic; (c) Right eye without cycloplegic, and (d) Left eye without cycloplegic. The following is an example:

R.E. with Cycl.	No. Case	Age in Decades	90	90 to 75	90 to 105	75 to 60	105 to 120	60 to 45	120 to 135	45 to 30	135 to 150	30 to 15	150 to 165	15 to 0\	165 to 180	180	Amt. of Ast.
	1	2	x														·50
	2	3		x													·75

The following is a summary of the observations made: The age of the eyes recorded turned out to be about one half under and the other half over 40 years, and in all except 3 cases (6 eyes) of the former the refraction had been done under a cycloplegic (2 per cent. homatropin and cocain sufficiently instilled). In the eyes over 40

(except one case, two eyes) no cycloplegic was used. It is considered unlikely that this difference had any material effect on the results obtained.

The average amount of the astigmatism of the plus cases was ·83 D. The point of interest which is brought out by the investigation relates to the gradual change in axis with advancing age. The so-called "rule" in astigmatism that the axis of a plus lens tends to be vertical is borne out by the figures of this paper so far as young eyes are concerned, but in elderly people they show the opposite to be the case. There appears to be, indeed, a slow turning of the axis from childhood to old age, but not decidedly either out or in, because the axis in oblique astigmatism runs down and out in 57 per cent. of the eyes, and down and in in 43 per cent.

If we place the eyes under 50 years old in one class and those above 50 in another, we find that in roughly 15 per cent. of the younger eyes the axis was nearer horizontal than vertical, and that it was nearer horizontal than vertical in 75 per cent. of the older eyes. Missing out decades I and IX in each of which there were only two eyes (vertical in the first, horizontal in the ninth) the respective percentages for the other decades from the second to the eighth, for axis tending towards the horizontal, were 10·6, 15·4, 23·0, 27·0, 56·3, 60·0, 83·3.

The average distance of the axis from the horizontal in each decade was measured by using the middle figure of each of the above-mentioned segments of 15 degrees each, which is close enough for our purpose. These distances were from the first to the ninth decades respectively:—

83·0, 75·4, 75·8, 65·6, 59·5, 39·8, 34·6, 26·3, and 4·0.

This paper has not been prepared with the idea that it is a final exposition of the subject, but rather in order to draw attention to it. The most conclusive proof that the axis turns with age would be provided by an examination of the same eyes at intervals through long periods of time, and probably most of the elder among ophthalmologists have noticed a change in the axis in many of their patients. Yet if further investigation does not contradict the above figures, the conclusion that the axis frequently tends with years to wheel from the vertical to the horizontal seems to be irresistible. The writer regrets that the number of myopic eyes supplies insufficient ground for any statement. It will make an interesting enquiry in connection with the present. Another point which remains to be definitely settled is whether the gradual change is entirely corneal, entirely lenticular, or a combination. I am inclined to think that it is corneal. The ophthalmometer would aid in settling the question.

CINEMATOGRAPH EYE IRRITATION

BY

JAMES ALEXANDER WILSON, O.B.E., M.D.,

GLASGOW

IT has been alleged that cinematograph displays have injurious effects on the eyes, especially on the eyes of young people. This may or may not be true, for so far but little evidence has been produced to support any conclusion.

During the war I was resident surgeon in a large hospital where these displays were given from three to six times a week. The people attending were adults, soldiers, nursing staff and the medical officers. Most of them did not suffer any inconvenience, some suffered slightly, but a few suffered severely. In the severe cases the eyes became hot, congested and painful, and had to be closed or turned away from the pictures. Personally I suffered much inconvenience, and felt constrained to take an interest in its aetiology.

What are the conditions under which this discomfort is produced, or in what manner do cinematograph conditions differ from normal visual conditions ?

The hall was large, and people entering after the exhibition had begun could not see to move about or to find a seat. They had to stand in the passage till their eyes got adapted to the darkness.

Photographs that have been taken in bright light when thrown on the screen show much pure white, yet the amount of light on the screen is such that the pictures would hardly be visible in full daylight; visibility is obtained by darkening the hall, and the pictures are brilliant only relatively to the darkness; thus the retinae are dealing with images that are feebler than ordinary images. We have a somewhat feeble central image, with the periphery almost in darkness, and the contrast is sharp. Although the picture on the screen gives the impression of continuity, it is really being rapidly changed. It is usually unsteady, jerking vertically or laterally; and, further, in a picture the sense of depth is artificial. What falls on the centre of the retina is not an image of objects standing out in relief and in natural colours, but it is an image of an image, and it is in black and white.

There are seven points that may be considered: (1) The vertical angle of view; (2) dark adaptation; (3) unsteadiness of the images of the pictures; (4) complexity of the images; (5) peculiarity of the fundus illumination; (6) the absence of natural colours; (7) individual susceptibility.

(1) The interim report of the joint committee appointed by the Illuminating Engineering Society states: "that the ocular discomfort arising is due mainly to the fact that the eyes of the

spectators are directed upwards at an abnormal angle." I usually sat 45 feet away from the screen, and the angle of elevation in my case was small and had nothing to do with the production of the discomfort. I never suffered from headaches, but my eyes became hot and painful. Occasionally luminous sensations, like scintillating scotomata, moved about the periphery of my field of vision. At first I thought some one was shining a flash-light on my waistcoat as I sat back in the chair. These are not symptoms of fatigue of the muscles that elevate the eyeballs, but of irritation of the retina. Experimentally I sometimes sat close to the screen, but the result was just the same. My eyes are normal in every way.

(2) In dark adaptation the standard of illumination is lowered and there is developed a condition of greater power to perceive dimly-lighted objects and fine differences in degrees of illumination. The occupation of the coal miner necessitates extreme dark adaptation and it is associated with eye trouble.

In the last year of the war several additional, open, electric roof lights were introduced into our hospital picture hall and during the intervals in the exhibition the hall was brilliantly lighted. This, in my experience, gave great relief.

(3) Is the discomfort produced by instability *per se*? If one reads a book in a railway train the book shakes and even if one reads under these circumstances for hours on end little or no discomfort ensues.

(4) A film, say of a landscape, with words printed over the photograph, one picture dissolving into another, or a fast moving object, are all irritating to the eyes. The eyes cannot focus blurred, confused, complex or rapidly moving objects. These fret and probably fatigue the eyes. Sharp retinal images are important for the comfort and the efficiency of the neuro-optical apparatus, and their prolonged absence is the cause of nystagmus. The nystagmus of the miner is usually associated with photophobia.

(5) The peculiarity of the fundus illumination is that the centre is occupied with a relatively bright image, while the periphery is in darkness. If the light on the screen is very bright, or bright in patches, or flashes, the peculiarity is exaggerated and the discomfort is increased.

Dr. Edridge-Green suggested that light falling on the periphery of the fundus liberates visual purple from the rods, and this, flowing towards the macula, supplies that on which vision depends. Here we have conditions which should test this theory, for if a definite law in physiology is broken, every person attending the display should suffer; but it is not so. If, during a cinematograph exhibition, a person sits close to the large screen, then the central image is much enlarged and the extent of the dark periphery correspondingly diminished; but still the discomfort is produced.

If that person sits at the back of the hall he suffers very little or not at all. In this position the screen conditions are much lessened and the screen is seen through some depth of diffused light.

Many people suffer discomfort during a lantern lecture. In this case there is no movement of the picture, but there is the uneven illumination of the fundus, a bright central image, a dark periphery and dark adaptation. Theatre headaches are recognised and here the lighting conditions are somewhat the same.

(6) The absence of natural colours in a photograph renders the identification of objects more difficult and increases the necessity for fixation and attention.

(7) The last point is individual susceptibility. The great mass of people do not suffer any discomfort, some suffer slightly and only a few acutely. One can only suggest as an explanation of this that some nervous systems are more sensitive than others.

Conclusions.—The locality of the discomfort is in the retina. In dark adaptation the retina is more sensitive to dim lights, more sensitive in every way probably, resenting coarse flashes of light, ill-defined and uncertain images. Dark adaptation seems to be one of the objectionable conditions. Could the necessity for this be diminished by raising the standard of light on the screen and in the hall? Brilliant illumination of the hall during the intervals is desirable. The pictures should be as steady as possible. Dissolving pictures should be abolished and so should printing over a landscape. Objects in rapid motion are irritating. Equality of lighting on the screen is desirable, i.e., avoiding strong lighting of white objects. Possibly dim lights placed beyond the screen to illuminate the periphery might be of service. I fancy the lowering of a green curtain during the intervals might be soothing, in so far as it would be a change from the monotony of black and white.

Does cinematograph irritation produce defective vision, or injure the eyes to the extent of producing disease? Frequently repeated irritation might produce some disease or simply defective vision, but I have never seen any that I thought had been so produced. Defective vision unassociated with error of refraction or eye disease, especially among scholars, was recognized before the cinematograph was introduced or before it came into general use.

ANNOTATIONS

International Congress of Ophthalmology

Six years have passed since the *International Congress of Ophthalmology* at Petrograd was postponed. Our brethren of the

United States have now taken definite action to remedy this state of affairs. The American Ophthalmological Society, the American Academy of Ophthalmology and Oto-Laryngology, and the Section of Ophthalmology of the American Medical Association, some time ago appointed committees to consider the question, and it has been decided to hold a meeting in Washington about the end of April, 1922. Application for membership in the Congress, with the fee of ten dollars, should be sent to Dr. W. R. Parker, David Whitney Building, Detroit, Michigan, and it may be noted that it is proposed to remit the dues from those outside America who make the journey to attend the Congress. Topics for discussion, offers of papers, and suggestions should be sent to Dr. Edward Jackson, 318, Majestic Building, Denver, Colorado. The officials of the Congress include Dr. E. C. Ellett, chairman of Committee on Organization, of Memphis, Tenn., Dr. William H. Wilmer, of Washington, D.C., chairman of the Committee of Arrangements, and Dr. Lee Masten Francis, of Buffalo, chairman of the Committee on Finance. We wish the meeting every success. At this juncture the American action is opportune and to be welcomed. It is to be hoped, however, that when circumstances permit, the Congress will fall into series with former International Congresses, and be conducted by a committee upon which all eligible nations are represented.

Departmental Committee on Blindness

Readers will be glad to learn that a committee has been appointed by the Minister of Health to investigate and report upon the causes of blindness, as well as of defective sight adequate to impair economic efficiency, and to suggest measures for prevention. The following have been asked to serve: Right Hon. G. H. Roberts, M.P. (chairman); Mr. Stephen Walsh, M.P.; Mr. N. Bishop Harman; Mr. J. B. Lawford; Mr. G. F. Mowatt; Mrs. Wilton Phipps; Mr. J. Herbert Parsons (representing the Royal College of Surgeons); Dr. James Taylor (representing the Royal College of Physicians); Mr. J. C. Bridge (representing the Home Office); Dr. A. Eichholz (representing the Board of Education); Mr. J. S. Nicholson (representing the Ministry of Labour), Mr. W. M. Stone (representing the Scottish Office); and Mr. E. D. Macgregor (representing the Ministry of Health). A representative of the Medical Research Council will be appointed later. Joint Secretaries: Dr. R. A. Farrar and Mr. P. N. R. Butcher, Ministry of Health, Whitehall, London, S.W. 1. From most points of view the Committee is sufficiently representative, and will doubtless accomplish excellent work. It is, however, open

to criticism from two points of view. In the first place, that important and useful body, the Council of British Ophthalmologists, is not directly represented, as it undoubtedly should be. Secondly, although the reference expressly includes causes that may lead to a defect in sight such as to impair economic efficiency, yet we miss the name of any member directly entitled by experience to speak upon this point. Take miners' nystagmus, for example, a condition that costs this country over a million pounds a year, can any member of the committee claim a first-hand acquaintance with that disabling ailment? Fortunately, even at the eleventh hour, it is not too late to remedy the second omission, if only the Medical Research Council sees proper to send as its representative one who has practical knowledge of occupational disability.

The Moorfields Appeal

The Royal London Ophthalmic Hospital, first established in Charterhouse Square in 1804, as the London Dispensary for Curing Diseases of the Eye and Ear, has several times changed its name. That by which it is most generally known throughout the Ophthalmic world is "The Moorfields Eye Hospital." It received the dignity of being converted into a Royal Institution in 1836 when Queen Victoria, then the Princess Victoria, together with her mother, the Duchess of Kent, became its patronesses. Since then the Royal family have several times manifested their interest in the Hospital. King Edward VII, when Prince of Wales, laid the foundation of the present building, which was opened by King George and Queen Mary, when Duke and Duchess of York, in 1899. Now, the President of the Hospital, Prince Arthur of Connaught, has issued an appeal for a fund of £100,000: (I) To enable it to pay off a heavy debt to its bankers. (II) To enable it to extend its laboratory accommodation for purposes of clinical and pathological research. (III) To supply adequately paid assistants to the Honorary Medical Staff, which will liberate them from much of the routine work which they now have to perform, and allow of them devoting more of their time to clinical instruction and research for which they are so eminently qualified. (IV) To supply adequate accommodation for the nursing staff, not only those who carry on the general work of the Hospital, but also those desirous of obtaining a special training in the nursing of cases of diseases of the eye.

The Hospital justly claims to be the parent of all similar institutions throughout the English speaking world, and it is issuing an appeal, not only in this country, but also in the United States of America, in the Dominion of Canada, and in the Empire of India.

Much is now heard about London becoming a great centre for post-graduate medical education. Moorfields Hospital has been a great centre for post-graduate ophthalmic education for over a hundred years. Medical men of all races and nationalities have flocked to it in large numbers to obtain instruction and experience in the treatment of eye diseases.

One of the first students of the Hospital was William Adams (afterwards Sir William) who left it to take up practice in Exeter, where he established "The West of England Eye Infirmary" in 1808, which has continued to carry on the good work then started up to the present time.

The American appeal tells us how in 1811, two young Americans, Dr. Edward Delafield and Dr. J. Kearney Rodgers, came to study at the Hospital. On their return to their own country in 1818, so impressed had they been at all they had learnt at the London Eye Infirmary, as it was then called, that they determined to establish a similar institution in America. This they succeeded in doing, and in 1820 founded "The New York Eye and Ear Infirmary."

In 1816 Dr. Edward Reynolds came from Boston to London, and attended the practice and lectures at this Hospital under Mr. Benjamin Travers and Sir William Lawrence. On his return home he found his father blind from cataract in both eyes. Fortified by his recent experience in London, he decided to operate. Happily the operation proved a complete success. It had never been undertaken in Boston before. Dr. Reynolds soon became the leading surgeon for diseases of the eye in that city and in 1824 founded "The Massachusetts Charitable Eye and Ear Infirmary." Since the time of these pioneers of American ophthalmology there has been a continuous succession of American medical men working in the different departments at Moorfields.

The appeal to Canada is pointed with a list of leading ophthalmologists of the Dominion who have held the appointments of house surgeon or clinical assistant at the hospital. It commences with the name of the late Dr. Frank Buller, of Montreal, who was House Surgeon from 1872 to 1874.

The appeal to India describes how, in 1819, the Directors of the East India Company were so impressed by the great prevalence of eye disease in the large and populous districts over which they ruled, and by the good work which the eye hospital was carrying on in London, that they determined to establish one on similar lines in Madras. For this purpose they sent to that city Surgeon R. Richardson, who had studied ophthalmology under Mr. Benjamin Travers, and he there founded "The Madras Eye Infirmary." This institution has been several times enlarged, and in 1888 its name was altered to that by which it is now known, "The Government Ophthalmic Hospital."

In 1824 two other surgeons who had been students at the hospital were sent out by the Company to found eye hospitals in Bombay and Calcutta. Very many Indan medical men and women have received their training at Moorfields; the supply of women doctors is particularly valuable to India, on account of the large numbers of women precluded from receiving assistance from men.

The appeal which is being issued in this country, whilst stating the lines on which it is hoped that future progress will be made, dwells more particularly on the great and pressing needs with which the Committee of the Hospital are at present faced. These have been occasioned by the enormously increased cost of every commodity, and by the rise of salaries. As the appeal pointedly says, the prevention and cure of blindness by means of voluntary contributions is surely better than doles (from rates and taxes) to those who have irretrievably lost their sight.

ABSTRACTS

I.—MIGRAINE AND GLAUCOMA

Lamb, R. S. (Washington).—Is migraine a forerunner of glaucoma? *Annals of Ophthalmology*, October, 1915, and *Trans. Colorado Congress*, 1915.

Lamb has had under his observation a large number of cases of migraine, and has made the following observations on them: (1) In all, the ocular tension was found to be up; sometimes slightly, sometimes markedly so; (2) in every one in which the headache was associated with intense photophobia, there was evidence of chorio-retinitis, especially in the central region; (3) the exciting cause of the attacks was frequently an error of refraction (hypermetropic astigmatism predominating), and in such cases more or less severe chorio-retinitis was always found; (4) the exciting causes of migraine, *viz.*, nerve exhaustion and nerve shock, are also those of congestive glaucoma; (5) both diseases are apt to occur in families; (6) both are associated with gout; (7) he has been unable to find common features in the fields of vision of the two diseases; but (8) clinically there are points of resemblance, for he has "been able to ascertain on which side the pain was in the habit of occurring by observing that the pupil of that side was more dilated, and the anterior chamber was shallow as compared with that of the other eye." There was also "a slight difference in the colour of

the iris . . . and definite, though slight ciliary congestion." Cases are given, and the treatment adopted is there indicated. A careful correction of errors of refraction, under a cycloplegic, the usual constitutional treatment, and the instillation of a weak miotic solution are its principal features. The paper is thoughtful, interesting, and stimulating; it constitutes a move off the beaten tract of stereotyped therapeutics and, as such, it deserves the sympathetic and careful consideration of all who are engaged, for the benefit of their patients, in the *study* of clinical ophthalmology. On the face of his evidence Lamb would appear to have made a case for watching of the tension of the eyes in all cases of migraine, and of exhibiting miotics, whenever that tension is raised. It may also be, as he suggests, that migraine cases later run on into glaucoma; it is to be regretted that he did not give more definite evidence on this head. It is, however, another and quite different proposition to maintain that migraine is "a forerunner of glaucoma." Lamb quotes Priestley Smith's definition of glaucoma. In his book on the subject, Priestley Smith defined glaucoma as "an excess of pressure within the eye, *plus* the causes and the consequences of that excess." Of recent years there has been a disposition, and we think a well-founded disposition, to believe that all excess of intra-ocular pressure is not necessarily glaucoma. A healthy eye can compensate for accidental increases of pressure that occur within it. It is the predisposed eye which falls a victim to glaucoma, under the strain of altered vascular conditions of the organ, or of the system generally, or of both. If Lamb's observations are confirmed, it will presumably be proved that migraine, which we regard as being central in origin, is associated with a grave alteration of the vascular condition in the eye itself, and that this alteration is of such a nature as to lead to the obstruction of the exit of venous blood from the uveal tract, thereby shallowing the chamber and dilating the pupil. We are justified in believing that these phenomena are the result of increased intra-ocular pressure, and that, provided the eye is in a condition predisposing it to glaucoma, a pathological increase of tension will take place. It is doubtful if we can go beyond this. The reviewer offers these observations with some little hesitation, for he feels himself indebted to Dr. Lamb for a paper which provokes thought, and suggests no small clinical possibilities. R. H. ELLIOT.

II.—SWIMMING BATH CONJUNCTIVITIS

Comberg, W. — On swimming bath conjunctivitis. (Ueber Badkonjunktivitis.) *Zeitschr. f. Augenheilk.*, Vol. XLIV, Part i-ii, 1920.

Comberg has had the opportunity of examining cases of swimming bath conjunctivitis, which during the autumn of 1919 assumed an almost epidemic form in Berlin. This condition was described by Schultz in 1899, who considered it to be a form of trachoma. Fehr, in 1900, published an article upon the same disease, and pointed out that, although in many respects similar to trachoma, it healed more rapidly, and that the upper lid improved sooner than the lower, whereas in real trachoma the reverse holds. Also, that complete cure with minimal, if any, scarring of the lids, was the rule. All Comberg's cases came from the same bath, and that the last built and best appointed in Berlin. The incubation period of the disease appeared to be ten days. It was characterized by an acute oedema of the conjunctiva, sometimes associated with swelling of the lids and enlargement of the preauricular glands. The skin of the lids was tense, red, and hot in these severe cases. Ptosis was generally noted. The secretion was but slightly purulent. The lids were generally stuck together in the morning.

The cases were treated with protargol daily and were touched three times a week with the copper alum pencil. Some of the cases were well in two or three weeks, but in others two to three months' treatment was necessary. No scars were left in the conjunctiva, the tarsus was not thickened, and pannus was never present.

Comberg considers that bath conjunctivitis is not trachoma. No organisms could be detected in the secretion, but in some cases inclusion bodies were seen in the cells of the conjunctiva. A piece of the inflamed conjunctiva was excised and examined. The condition found is fully described in the text; it was not similar to trachoma. Comberg inspected the bath to which the infection was traced. The male bath, more used than the female bath, contained eight times as many organisms as the female, and all the patients were males. The bath attendants had normal eyes, showing no trace of conjunctivitis. The cubicles were clean, and were washed daily with sublimate solution. The bathers brought their own towels and costumes. It was suggested that the water should be chlorinated, and that steps should be taken to prevent infected persons from using the bath.

T. HARRISON BUTLER.

III.—ULTRA-VIOLET LIGHT IN DISEASES OF THE CORNEA

Birch-Hirschfeld (Leipzig).—Upon the treatment of inflammatory corneal diseases, and especially serpent ulcer, with ultra-violet light. (Zur Behandlung entzündlicher Hornhauterkrankungen besonders des Ulcus serpens mit ultravioletten Licht.) *Zeitschr. f. Augenheilk.*, Vol. XLIV, Part i-ii.

Birch-Hirschfeld has carried out much experimental work in connection with the harmful effect of ultra-violet light upon the eye, and has confirmed the opinion that it may be responsible for conjunctivitis, retinitis, cataract, and keratitis. On the other hand, the same rays have been useful in the treatment of certain skin diseases and infections of the mucous membrane, and it seemed to him that it was worth while to investigate their action upon the cornea, and especially upon serpent ulcer. Twelve years ago Hertel, using the Cadmium zinc lamp, which furnishes intense ultra-violet rays, obtained good results in this disease. Twenty-six cases were healed with good vision, but in 13 cases out of 47 the light failed to inhibit the spread of the ulcer. Chotzen and Kuznitsky treated chronic keratitis with rays from a mercury-vapour lamp with a quartz attachment, and stated that they obtained good results when all other treatment had failed. Hertel's work made the author wish to take up the light treatment of corneal ulcers, but the success of optochin, which was being tried at Leipzig, postponed the attempt. Experience showed that optochin had been over-rated, and that many ulcers had to be cauterized and treated by section. Out of 62 cases of pneumococcal ulcer treated with optochin at Königsberg, only 13 were cured. Other surgeons, including Wessely, Gruter, Bluhm, Dubois, Gradle, and Schnyder have spoken unfavourably of optochin. These disappointments opened the way for a trial of ultra-violet light. Not having a Cadmium zinc lamp the author contented himself with a small arc-lamp in front of which he fitted a uviol glass and a quartz lens of 20 dioptres. The surgeon held a second quartz lens between his thumb and index finger further to concentrate the rays upon the advancing edge of the ulcer. Most of the luminous rays are absorbed by the uviol glass, and no discomfort was caused by glare or heat. The experiment was not crowned with success, especially with respect to pneumococcal ulcers, which continued to spread. Accordingly the absorptive power for ultra-violet rays was exalted by sensitizing the cornea with a 2 per cent. solution of fluorescein. Forty-three pneumococcal ulcers taken consecutively without selection were treated in this manner. In 40 the treatment was carried out to its conclusion with the result that only 6 cases failed to receive benefit. These were

severe and neglected cases. In the remainder good results were obtained. In many of the severe examples improvement was evident after a few irradiations of from 3 to 5 minutes once or twice a day. No trace of any ophthalmia electrica was noted, because the short wave-length light was concentrated upon the ulcer and did not fall upon other tissues. In 33 cases treated by light alone the functional result was good. The number of applications called for was very varied. In 12 cases 5-7 days sufficed, whereas in one case the irradiation was continued for 27 days. Experience alone can decide the necessary time and frequence of the light application. The apparatus is simple and comparatively inexpensive. Koepp's lamp appears to be the best for the purpose. The author has grave doubts as to the value of irradiation for trachoma.

T. HARRISON BUTLER.

IV.—TEMPORARY PARALYSIS OF THE LIDS IN CATARACT OPERATIONS

Villard, H.—Temporary paralysis of the lids in cataract operations. (Paralysie temporaire des paupières dans l'opération de la cataracte.) *Bulletins de la Société française d'Ophtalmologie*, 1919.

Villard, in order to eliminate all risk of "squeezing" in nervous patients and thus prevent loss of vitreous, makes a subcutaneous injection of novocain (1/100) and cocain (1/150) over the fibres of the facial nerve as they spread out to supply the orbicularis muscle. He uses a syringe holding about 5 cc. with a needle about 3-4 cm. in length. Three injections are made, the first vertical a little above and behind the eyebrow deeply into the malar region, the second from where the point of the needle has penetrated horizontally towards the upper part of the ala of the nose, 1 cm. below the infra-orbital margin. By these two injections he has practically encircled the outer and lower part of the orbital margin and thus caught all the filaments of the facial nerve. The third injection is made at the external commissure and is directed outwards towards the parotid. About two cc. of fluid are used for each injection.

After 2-5 minutes the lids can be separated without the smallest resistance on the patient's part, and when the effect has reached its maximum the eye cannot be closed by voluntary effort. The duration of the paralysis is from ten to fifteen minutes.

In order to avert any toxic action a strong cup of coffee is taken immediately before the injections are commenced.

The disadvantage is that the patient is unable to close the eye

after operation; the gentle pressure of a dressing will; however, get over this difficulty.

The great advantage is the perfect calmness which is produced and which does away with the necessity for an assistant.

C. KILLICK.

V.—WOUNDS OF THE CILIARY REGION

Lagrange, Professor (Bordeaux).—The gravity of wounds of the eye according to whether the ciliary region is or is not involved; the treatment of such wounds. (Des plaies de l'oeil, leur gravité selon que la région ciliaire est ou non intéressée; leur traitement.) *Rev. gén. d'Ophtal.*, February, 1920.

This article is short, but of great importance. **Lagrange** indicates that a more elaborate publication is in contemplation. The author's object, very largely as the result of extensive war experience, is to formulate certain rules for the guidance especially of those whose personal experience has not yet been sufficiently extensive to yield them a firm opinion on the subjects of prognosis and treatment of ocular injuries. His experience has convinced him that wounds of the ciliary body, other things being equal, are much more dangerous than wounds of other parts of the globe. This is in conformity with the views of such classical writers as Arlt, Röhmer, and Sichel, as opposed to those who hold the opinion that the danger depends upon the infective agent and not upon the situation within the eyeball. Lagrange, indeed, points out that even in the absence of foreign body, and without infection, a wound of the ciliary body may be quite destructive of the eyeball, the nutrition of which is thereby completely upset.

Lagrange classifies the wounds of the eyeball as follows:

(1) Wounds of the ciliary region—(*a*) with foreign body in the eye, (*b*) without foreign body in the eye.

(2) Wounds outside of the ciliary region—(*a*) with foreign body in the eye, (*b*) without foreign body.

His experience of these groups may be summarized:

(1) (*a*) 18 cases. 3 cases of sympathetic ophthalmitis. 15 cases in which the end was either enucleation or phthisis bulbi. So that a wound of the eye in the ciliary region with foreign body, whether that foreign body remains in the ciliary region or lodges elsewhere in the eye, is fatal to the eye. (The author does not seem to mention whether this absolutely fatal prognosis is in any way modified by removal of the foreign body, but the reviewer assumes that the author means to state that penetration of the ciliary region by a

foreign body is fatal to the eye whether the foreign body is removed or not).

(1) (*b*) Again 18 cases. 2 cases of sympathetic ophthalmitis. A useful eye retained in 7 cases. The remainder lost.

(2) (*a*) 32 cases. Only 1 enucleation. The remainder relatively satisfactory. V.A. from 8/10 to 1/100. Magnetic foreign body extracted 5 times. 12 times the non-magnetic foreign body (generally copper) remained in the eye without causing trouble necessitating enucleation.

(2) (*b*) 15 cases. Enucleation in 2 cases. 10 cases with acuity from 10/10 to 1/50. 3 cases with normal tension but no vision.

The author calls special attention to the fact that in the second group of cases there was no sympathetic disease. Admitting the existence of a special infective agent, it is evident that this organism requires a special medium for its multiplication, and that the ciliary body, owing to its complex structure and the richness of its nerve plexus, offers the necessary favourable soil.

Wounds of the eyeball are thus to be arranged in the following decreasing order of gravity:

(1) Wounds of the ciliary body with foreign body.
(2) „ „ „ „ „ without „ „
(3) Wounds of the eye outside the ciliary region, with f.b.
(4) „ „ „ „ „ „ „ „ without f.b.

The statistics show that it may be better that there should be a wound with foreign body in the posterior hemisphere than a wound in the ciliary region without foreign body. The author confesses that, although admittedly sympathetic disease was very uncommon in the late war, he is nevertheless very much afraid of it, since he personally saw a number of cases. His "rules of conduct" have also been influenced by his opinion that a well-fitted artificial eye is better than an unsightly damaged one.

The author's "rules of conduct," which have been drawn up for the use of those who have had insufficient personal experience to come to a firm conclusion as to the line of treatment best to be pursued in these difficult cases, may perhaps be omitted here. They are on the usual lines, and are as clear as such rules—made to be broken on occasion by every man of experience—can be.

ERNEST THOMSON.

VI.—DETACHMENT OF THE RETINA

Gonin, J.—The anatomical causes of retinal detachment. *Ann. d'Ocul.*, Vol. CLVI, May, 1919.

Gonin has been able to make a collection of some hundreds of half eyeballs in gelatin, and finds on examining them that he can put them into four groups, according to the different mechanisms at work. Thus, displacement of retina, ***amotio retinae***, can come from raising up of retina, ***sublatio retinae***, by vis a tergo under direct pressure of choroid itself displaced or thickened by tumour, or rather by the intermediation of an effusion of liquid between choroid and retina; from attraction of retina, ***attractio retinae***, by a force acting on its anterior surface, either by direct action of vitreous in a state of pathological retraction, or by the cicatricial retraction of adhesions created between retina and a wound of anterior segment of eye; from distension of retina, ***distensio retinae***, followed by tearing or by separation from one of its insertions; from depression of retina, ***depressio retinae***, a phenomenon exactly opposite to the last, and manifesting itself by a folding of the nervous membrane, consecutive to a sudden or slow diminution of the volume of the eyeball.

The first group includes all degrees of detachment from the complete, as seen in the expulsive haemorrhage cases, to the slighter varieties. Some small choroidal tumours have a lot of fluid exudate, other larger tumours may have little or none. Sometimes choroid remains in place and a haemorrhage or exudate lifts off the retina, a serous exudate occurring from some inflammatory cause in the neighbourhood, ***e.g.***, scleritis, acute choroiditis, abscess of cornea, suppurative cyclitis, or from some circulatory trouble such as orbital tumour or albuminuric retinitis. Haemorrhages are sometimes spontaneous as in diabetes, arterio-sclerosis, or they have a traumatic origin from contusion or perforation. Folds of retina are here not numerous, while the retro-retinal exudate differs in consistence, colour and chemical composition from the liquid which fills the hyaloid space, but in some cases after violent and prolonged inflammation there is an apparent identity, as in certain metastatic suppuration cases. His collection has 90 examples of this vis a tergo group, but if one takes away those where the retina remains in contact with the choroid itself raised up, and those where the retro-retinal exudate has been but an epiphenomenon of the development of the tumour, there remain but 10 examples where the detachment can be due to a primary exudate of the choroid. Hence, Gonin thinks operations for removal of the fluid are not likely to be of much use.

In the attraction group are quite a number in which the vitreous, by reason of diverse alterations, ***e.g.***, haemorrhagic infiltrate, chronic inflammation or suppuration is not only detached from the retina, but even retracted right up to the equator without the retina having anywhere left its normal situation. There must be adhesions between vitreous and retina before retraction of the

former displaces the latter. These adhesions may be old or produced just before the retraction of the hyaloid. In the presence of a total suppuration of the vitreous, the welding is often complete to the point that one can only with great care distinguish the vitreous mass from the retina and that it detaches itself from the choroid in all its extent. The funnel shape is often present, but in many of Gonin's cases the retina appears to have torn away from the disc, when vitreous and retina together form a yellowish mass on the back of lens or ciliary body. Welding may be local and not general and thus allow local detachments to occur, and in these the tears, emphasized by Leber, sometimes appear valve shaped and sometimes quite obviously punched out, especially about the ora serrata. The hyaloid fluid at once gets access to the retro-retinal space so that in recent cases the two spaces have similar fluid, but in older specimens in which the communications may have become shut off the fluids are different, the retro-retinal space showing relics of haemorrhage or cholesterin, while the retina, reduced to a cord, encloses the relics of the vitreous. Attractions independent of the vitreous body are usually due to perforating injury at the ciliary region, where the greater haemorrhage may lead to greater retraction. Where the track of a foreign body involves retina, choroid, and sclera, the whole globe tends to become deformed. In 125 of Gonin's cases attraction was the cause, i.e., 40 per cent. of the cases of detachment. Of these about ten were idiopathic, the others followed traumata: retraction of vitreous and cicatricial retraction of a perforating wound were about equally responsible with each other for the detachment.

The third, or distension, group is best seen in myopia, where the retina is far from being so inextensible as one supposes, especially in the presence of a slow and continuous distension where it shows a great adaptability—it becomes very much thinned out but is not detached. His specimens show such in high myopia and glaucomatous macrophthalmia and there is actually one with a marked lateral staphyloma where the retina is in place over the distended portion, while on the opposite side it is detached without any tear. Contusions must be sudden and violent to cause detachment with or without scleral rupture and here partial or complete tears of retina may occur at ora serrata or at disc, usually the former. In his series Gonin can find only ten cases where retinal rupture from distension can reasonably be admitted.

The fourth, or depression, group is the counterpart of the previous group and includes cases where the sclera becomes reduced in extent by brisk depression with copious loss of vitreous or even slow atrophy, so that the retina becomes much folded, although not necessarily accompanied by compensatory choroidal exudate.

The paper has 18 figures in the text.

Gonin admits the existence of mixed and intermediate forms, but thinks his classification may be quite useful macroscopically. He hopes to discuss in a further article how such groupings can be made clinically, and also the methods of treatment suitable to each form.

W. C. SOUTER.

VII.—EPITHELIOMA OF THE BULBAR CONJUNCTIVA

Cosmettatos, G. F. (Athens.)—Recurrent epithelioma of the bulbar conjunctiva—death by metastasis. *Ann. d'Ocul.*, Vol. CLV, January, 1918 (with three figures).

Cosmettatos brings forward the present case because of the peculiar histological features and of the rarity of metastasis in these cases. In or about September, 1908, the man had had an apparently trivial injury to the right eye with a chip of wood; one year later there appeared on the ocular conjunctiva towards the outer canthus a small excrescence growing slowly so that after a year it was the size of a coffee bean; at this time it was extirpated. The eye never became quite quiet, and after two months the tumour recurred at the same place and became as big as a small almond. This was again operated on, but recurrence having taken place the patient came to Cosmettatos in May, 1911, the man being then 30 years of age. The tumour mass appeared to be free from ocular conjunctiva and to arise from episclera, painless, sharply circumscribed: vision normal; other eye normal. Complete extirpation of tumour, cauterization of base, suture, good recovery, went home "cured." The tumour sections showed a connective tissue envelope with processes passing inwards, enclosing epithelial masses. The cells were grouped round the papillary axis, basal cylindrical cells, then a layer of polygonal cells, finally flattened epithelial cells, on the surface of the tumour. The irregular aspect of the epithelial masses, the abundance of abnormal karyokineses, and the rapid recurrence of the tumour, all pointed to malignancy, and in April, 1912, he came back with a large tumour coming out between the lids, frankly epitheliomatous now, size of chestnut, colour red, surface bleeding, lids free except that the palpebral conjunctiva far above was apparently invaded. Enucleation of eye and removal of infiltrated conjunctiva, thermo-cautery, uneventful recovery, home after 15 days. No gross change seen in the opened globe, but sections showed invasion of corneal lamellae and round the canal of Schlemm, while the peculiar irregularity of the disposition of the karyokinetic figures was quite a feature. Normally, these figures have their long axes at right angles to the basal membrane of the papilla, but in malignant cases, where the

epithelial cellular masses have a strong tendency to penetrate the tissue deeply, these figures lie not solely at right angles, but often parallel or obliquely to the base line. In adenomata and warts the axes are at right angles always.

Eight months later pains returned at the eyebrow, where a palpable tumour appeared, headache came on, and a year later death from cancer of larynx.

Death from metastasis in such cases has not been often recorded. In Noyer's case the eye was excised for epibulbar epithelioma, and the patient later died of an intestinal affection. de Wecker's case had the eye removed for an epithelioma big enough to prevent closure of the lids; five months after operation tumour reappeared in the orbit; and six months later the patient died from an intermaxillary epitheliomatous metastasis. Robineau and Courserand's patient of 55 had an epibulbar epithelioma removed, and five months later parotid metastasis appeared, causing the death of the man after extirpation of the second tumour.

W. C. SOUTER.

VIII.—RENAL RETINITIS

Hanssen, R. and Knack, A. V. (Hamburg-Barmbeck). — On the question of renal retinitis. (Zur Frage der Retinitis nephritica.) *Klin. Monatsbl. f. Augenheilk.*, September-October, 1917.

Hanssen and Knack, in a lengthy and diffuse paper accompanied by numerous tables and case histories, and illustrated by microphotographs, give an account of the cases of renal retinitis lately under observation in the Hamburg-Barmbeck general hospital. They have adopted the classification of Volhard and Fahr (*Die Brightsche Nierenkrankheit*, Berlin, 1914, Springer), in the arrangement of their cases, dividing them into three main groups:—

1. Primary degenerative, nephrosis. 2. Primary inflammatory, nephritis. 3. Kidney affections in which vascular sclerosis is the prominent feature. A table giving the clinical symptoms characteristic of the three groups is attached.

The conclusions drawn by the authors occupy nine pages, largely filled with quotations from other well known authorities. In their opinion, albuminuric retinitis is mainly an inflammatory affection of the retina, frequently accompanied by a similar affection of the choroid. The suggestion of Leber and others, that the retinal affection is caused by an ischaemia of the small blood-vessels is

considered as opposed to all general pathology; such a condition never leading to the inflammatory changes described by the authors. In several of their cases, there was considerable disease of the interior of the eye with practically no change in the vessels.

Hanssen and Knack come to the conclusion that renal retinitis is due to more than one cause. They hold the impression strongly that the same poison works on parallel lines on the kidney and the eye. In other groups, the retinitis is directly dependent on the nephritis and due to interference with the retinal metabolism.

E. E. H.

IX.—MISCELLANEOUS

(1) **von Skramlik (Freiburg i. Br.).—Argyrosis of the lacrymal sac. (Argyrose des Tränensackes.)** *Klin. Monatsbl. f. Augenheilk.*, April-May, 1915, p. 443.

(1) **von Skramlik's** patient was suffering from corneal ulcer, and had used a 1 per cent. solution of colloidal silver regularly for three weeks, and occasionally during a year. A pronounced grey-violet discolouration of the whole conjunctiva resulted, mainly in the lower fornix. Chronic dacryocystitis was also present, and the lacrymal sac, on removal, was found to be similarly discoloured.

A careful description of the microscopical appearances is given, The deposit of silver was found to have produced two different sets of changes.

1. The subepithelial connective tissue was stained brown in varying degrees of intensity. This decoloration was diffuse, and not due to the deposit of granules of silver.

2. In addition to the diffuse staining, there were many granules, grey to black in colour, both in the superficial and the deeper parts of the wall of the sac. These granules were almost exclusively intracellular or deposited on elastic fibrils. Both the diffuse staining and the granules soon disappeared in the presence of a 5 per cent. potassium cyanide solution. The author regards the diffuse staining as due to silver albuminate and the granules as metallic silver.

H. M. TRAQUAIR.

(2) **Charles, J. W. (St. Louis). — Suspected teeth and the Wassermann reaction in the Missouri School for the Blind.** *Amer. Jl. of Ophthal.*, April, 1917.

(2) **Charles** has already published (*Amer. Jl. of Ophthal.*, March, 1917), under the title, "Dental stigmata of syphilis and trans-illumination in the demonstration of Hutchinson's teeth," the fact

that among 106 pupils a certain number exhibited evidence of disturbed nutrition at the time of the laying down of the enamel, which had led to uneven or wavy lines in the enamel of the central incisors which could frequently best be seen by means of trans-illumination. Charles calls these "atypical Hutchinson's teeth," while the real Hutchinson's teeth are due to a total want of the enamel tubercles, resulting in the notching as well as narrowing of the incisal edge.

The dentist to the School for the Blind (Dr. Chase) has now selected all the pupils who exhibited any irregularities in the teeth, and all these have been subjected to the Wassermann test. Spinal puncture was only done in selected cases. We have here, then, eleven individuals of ages ranging up to 21 years, all of whom have suffered from severe eye disease and all of whom present some dental irregularity. Of these eleven, seven presented a negative Wassermann and four were positive. The author concludes: "When one considers the statistics of syphilographers, we find the proportion of positives sufficiently high to make these teeth significant as indices, although not pathognomonic."

ERNEST THOMSON.

(3) **Weve, U.—The light-sense of the larvae of calliphora erythrocephala (meat fly?). (De licht-zin der larven van calliphora erythrocephala [vleesch-vlieg]?)** *Nederlandsch Tijdschrift voor Geneeskunde*, 1916, Part i, p. 195.

(3) The larvae of this fly move away from a source of light. **Weve** measured their sensibility to light of different colours, and found that their sensibility was strikingly conformable to that of colour-blind people. They possess a well-developed adaptation to light. The organs to which the sensibility to light is due are situated in the first or head segment. For description of the methods used, see the original. (Weve's article appeared also in German in *Zeitschrift für Sinnesphysiologie*, Bd. XLIX).

G. F. ROCHAT.

(4) **Henkes, T. C.—A case of gangrenous inflammation of the frontal sinus, with purulent disease of the ethmoidal cells, and perforations in the orbit. (Een geval van gangreneuse ontsteking van den voorhoofds boezem en etterige ontsteking der zeefbeen cellen, met doorbraak naar den oogkuil.)** *Nederlandsch Tijdschrift voor Geneeskunde*, 1916, Part i, p. 2379.

(4) Notwithstanding the extremely severe disease of the frontal and ethmoidal sinuses, the patient had *never* before complained of headache. After the operation, in which the trochlea and the lamina papyracea had been totally removed, the eye movements were quite normal.

G. F. ROCHAT.

(5) **Gallenga, Dr. Prof. C. (Parma). — Vascular changes in pterygium. (Le alterazione vasali nello pterigio.)** *Arch. di Ottal.*, March-May, 1918.

(5) **Gallenga** gives a brief summary of the vascular changes he has found in the various kinds of pterygium. His statement is as follows:

"The vascular alterations in pterygium consist in a slow and progressive fibrous and hyaline degeneration of the vessel walls resulting in contraction and obliteration of the lumen of vessels and capillaries; accompanied by obliteration of the lymphatic vessels of the body of the pterygium with a corresponding considerable dilatation of those of the basal part, resulting in the formation of large lymphatic spaces from distension of the more conspicuous lymphatic trunks of the superficial and deep rete.

These alterations in the blood and lymphatic vessels are accompanied *pari passu* by diffusion and extension of the hyaline degeneration into the connective tissue stroma, and by alterations of the corneal surface especially affecting Bowman's membrane.

The disturbances of circulation and nutrition that result assist the diffusion of the degenerative processes in the conjunctiva which forms the pterygium.

The frequency then of the dilatations of the lymphatic vessels in the base of the pterygium, together with the obliteration of the lymphatic branches in the proximal portion of the apex, may give rise to the formation of some of the cysts previously described."

E. E. H.

(6) **Hardy, William F. (St. Louis).—Renal choked disc.** *Amer. Jl. of Ophthal.*, December, 1916.

(6) The article, by **Hardy**, which he entitles "Renal choked disc," is one of a type which somehow appears to be fairly common with American writers, in which a very large number of distinct statements is made within a short compass. Such articles, however intellectually nutritive they may be, and this is one of that character, almost defy the power of a *précis* writer to reduce them to shorter form. The present reviewer will not attempt the task, but at the same time it is right that he should reproduce the following statements by the author, as indicating the lines upon which the latter goes.—"The contentions embodied in this paper, and made a prelude to the direct discussion of renal choked disc, are (1) that optic neuritis and choked disc are aetiologically distinct entities; (2) that the assumption of a manifold pathogenesis of choked disc is probably incorrect; (3) that papilloedema is primarily of mechanical origin, all the concomitant phenomena being accountable for on that basis; (4) that the inability

to always clinically distinguish between the two conditions does not necessarily imply a common origin or identical process; (5) that optic neuritis is primarily and essentially an inflammatory process; choked disc is primarily and essentially an oedema and lymph stasis, the resultant of increased intracranial tension; (6) renal choked disc exemplifies both processes, each with its separate pathogenesis, showing a lymph stasis with oedema and also pathological changes." The reviewer thinks that it would be impossible for him to present the author's paper in brief any better than is done in these introductory words by the author himself.

ERNEST THOMSON.

(7) **Hardy, William F. and Lamb, H. D. (St. Louis).—Essential shrinking of the conjunctiva with a report of two cases.** *Amer. Jl. of Ophthal.*, October, 1917.

(7) **Hardy** and **Lamb** give a very full bibliography of the literature of ocular pemphigus and what has been called "essential shrinking" of the conjunctiva. They show that pemphigus of the eye occurs statistically once in 20,000 eye cases. Pergens divided the cases into four groups. (1) Those with vesicles on the skin and finally on the mucous membrane. (2) Cases without vesicles on the skin, but with them on the mucous membrane. (3) Cases in which vesicles were seen only on the eye. (4) Those cases in which no vesicles whatever are found. These last are the real cases of "essential shinking." The authors offer a classification of their own, as follows, namely: (1) Those cases with skin lesions or blebs on mucous membranes other than those of the eye. (2) Those associated with syphilitic pemphigus or syphilitic conjunctivitis. (3) Those with no antecedent history of skin or mucous membrane involvement. These last are cases of "essential shrinking." The authors hold, with Adam, that the conjunctival shrinking, following pemphigus, is not "essential" shrinking, but is a cicatrization of the subepithelial and adenoid layer of the conjunctiva. The term "essential shrinking," is more strictly applicable to the slow chronic process which characterizes the disease without antecedent pemphigus. The two cases reported by Hardy and Lamb themselves appear to have followed pemphigus. The bibliography contains seventy-six references and will be of value to other writers.

ERNEST THOMSON.

BOOK NOTICES

Tropical Ophthalmology. By R. H. ELLIOT, Lieut.-Col. I.M.S. (retired). Pp. xxiii and 525, with 7 plates and 117 illustrations. Oxford Medical Publications: Henry Frowde; Hodder and Stoughton, 1920. Price, 31s. 6d. net.

This book will be a boon to workers in all warm climates. Nothing of the kind has existed hitherto. And Col. Elliot, apart from his striking literary gifts, is one of the few men who have been in a position to write such a book. Given exceptional experience, the material must be collected, recorded and sifted steadily for many years. The holding of a teaching appointment is almost necessary as an incentive. And the widely scattered literature of the subject has to be sought, mostly buried under labels in no way suggestive of climatic influence.

As the author remarks, those qualified for this work are generally too climate-wearied to care for the task. Students in India have long felt the need for a readily available account of common tropical eye conditions.

The introductory chapters supply the keynote of the whole; they show an overpowering sense of the medical man's responsibilities and opportunities among the benighted poor in the East. The successful surgeon's life there is a hard one, upon which no man should venture unprepared, "to spend himself and be spent" while health and strength permit.

These early pages, with their insight and sympathy, show a much more intimate acquaintance with native life than is usual in Europeans in India. The first-hand narrative of appalling primitive ignorance and superstition possesses a vivid human interest.

Excellent descriptions are given of glare asthenopia and of sun blindness. Severer grades of the former seem to be relatively more common in Madras than further north in India, possibly owing to the want of the annual tonic influence of a well-marked cold season. A painfully true picture is drawn of the miserable condition of the child sufferers from (primary, epithelial) xerosis of the conjunctiva. Mention might be made of the abnormal pigmentation of the affected areas in Indians, including the whole of the corneal surface when this is involved. There is no such pigmentation in (secondary, parenchymatous) xerosis the result of cicatricial shrinking or exposure of the conjunctiva.

There is a sound practical chapter on the spread of ophthalmia in the East.

The comprehensive sections on injuries and diseases produced by

animal pests and parasites are evidently the result of wide literary research, especially valuable to men scattered far afield.

The study of cataract couching and its results is one which Col. Elliot has made particularly his own, with characteristic thoroughness, as seen in his Hunterian Lectures for 1917.

No fault can be found with the very practical general directions for cataract extraction in the East. Without being hyper-critical, one might perhaps expect to hear more of Smith's intracapsular operation as a peculiarly Indian procedure, and to that extent tropical. Its extraordinary vogue in India is a matter of considerable interest, with its failure to penetrate effectively elsewhere. An omission may be noted among the drawbacks given of this method, viz., a definitely high rate of iris prolapse, regarded by some as perhaps the chief objection to this operation, since excision of the prolapse may entail impaction or loss of vitreous.

Smith's very valuable method of lid control is evidently practised a good deal in Madras. Possibly the very free instillation of cocain with adrenalin now utilized by some surgeons in India, may largely remove the need for special lid control.

No mention is made of moistening the cornea during operation. In the very hot northern plains of India patients and surgeon alike are often averse to cataract extraction in the hot weather. After some experience of Sind the reviewer believes that with the help of a fan in a closed room, any such restriction is unnecessary, except when a dust storm is actually blowing. But sterile water should be dropped on the cornea, as may be necessary, especially if free cocain instillation is practised. The keratitis mentioned on page 282 of the book may be the result of drying of the cornea during operation.

In the section on the conjunctiva, cornea, lids, etc., the reviewer is glad to meet some old acquaintances. It has always seemed inexplicable that earlier workers in India should have left absolutely no record of observations such as are here collected. Fig. 81 shows the moderate pigmentation characteristic of bulbar spring catarrh in dark- and yellow-skinned races.

The lid thickenings mentioned on page 346 have proved to be due essentially to colloid (hyalin) degeneration of the tissues, sometimes with further secondary changes, *e.g.*, in one recorded case, true bone formation.

The final section on eye-affections in general diseases contains much of interest, such as the recent observations on dysenteric conjunctivitis and iritis. The vexed question of malarial eye affections is treated fairly and impartially.

The book is fully illustrated from photographs, excellently reproduced. It is everywhere concise, but thorough, and apparently with no serious omissions. As is to be expected of Col. Elliot, the descriptions are refreshingly apt, clear, and forcible. Doubtless

it will long remain the standard work on the subject, with every probability of new editions being called for. It cannot fail to add to the author's high reputation.

H. HERBERT.

Diseases of the Eye. By M. STEPHEN MAYOU. Third edition. London: Henry Frowde, Oxford University Press; Hodder and Stoughton, Ltd., Warwick Square, E.C. 4. Pp. 326, with 124 original illustrations and eight colour plates. Price 10s. 6d. net.

This text-book is one of the valuable series of the Oxford Medical Manuals. The author in his preface to the third edition states that in consideration of the fact that the medical student's curriculum is already overburdened, he has only added such new material as was necessary to bring the volume up to date. As is only right in such a text-book the author is somewhat dogmatic, but always lucid and easy to follow. The illustrations, especially the pathological ones, are of considerable value and should prove of much assistance to the student in following the text descriptions. We would particularly commend the account of the hook operation for iridotomy, which was described in the March number of this journal. On page 245 the author advises that a little protargol should be left in the lacrimal sac after irrigation. We do not think this is safe advice to give as we have ourselves come across three cases in which this procedure was followed by severe silver staining.

The volume is of a handy size for the pocket and should prove one of the most useful of students' handbooks.

E. E. H.

NOTES

Deaths

WE regret to announce that W. P. Nuël died at Liège on August 21, 1920. Born at Tétange, in the Grand Duchy of Luxembourg, in 1847, he pursued his professional studies in the University of Gand, of which he became a doctor of medicine in 1870. He then worked with Panas, Galezowski, Snellen, and Saemisch. His next step was to go into general practice at Eich, a small village near Luxembourg. The scientific work accomplished in that remote village attracted general attention, and in 1877 Nuël was called to the chair of ophthalmology in Louvaine. A few years later (1880) he was appointed professor of physiology in the University of Gand. From 1885 to 1919 he was professor of ophthalmology and of the

physiology of the special senses in the University of Louvaine. It was there that he made his reputation as one of the most accomplished European ophthalmic surgeons. His contributions to Landolt and de Wecker's *Traité Complet* and to Norris and Oliver's *System of Diseases of the Eye* are well and widely known, although they form but a small part of his contribution to ophthalmological and general science. Nuël was one of the founders of the Belgian Ophthalmological Society. The Commander of the Order of Léopold was bestowed upon him in recognition of the services rendered by him during the war.

Dr. Bjerrum is dead at the age of 68.

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Honour

THE C.B.E. has been bestowed upon A. F. McCallan, director of Egyptian Government Ophthalmic Hospitals.

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Registration of Charities for the Blind

ALTHOUGH the war is finished, yet, curiously enough, the War Charities Act (1916) still stands, and has now, according to a Ministry of Health circular, been applied to all charities for the blind. It is in consequence no longer legal to make any public appeal for donations for the blind unless the charity which solicits help is registered.

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American Ophthalmological Society

THE present officers of this Society, elected at the meeting in June last, are Dr. John E. Weeks, New York City, President; Dr. W. M. Sweet, Philadelphia, Vice-President; Dr. T. B. Holloway, Philadelphia, Secretary-Treasurer.

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Appointment

WILLIAM HISLOP MANSON has been appointed to the Chair of Ophthalmic Medicine and Surgery in the Anderson College, Glasgow.

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Middlemore Prize

THE Middlemore Prize has been awarded to Harry Moss Traquair for his essay on perimetry (inclusive of scotometry), its methods and its value to the ophthalmic surgeon.

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Michel Brisseau

THE Belgian and the French Ophthalmological Societies have united to raise a monument (to be unveiled in September, 1921) to the memory of Michel Brisseau in his native town of Tournai. The main facts have already been stated in our September number (p. 421). Any British ophthalmic surgeons who wish to contribute to the memory of this benefactor of mankind may communicate with Sir Anderson Critchett, Bt., Harley Street, W. 1.

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D.O.M.S.

AT a recent quarterly meeting of the Council of the Royal College of Surgeons of England, Mr. J. Herbert Parsons, Mr. E. Treacher Collins, and Mr. Willoughby Lyle were elected examiners for the conjoint diploma in Ophthalmic Medicine and Surgery. At the same meeting diplomas were granted, in conjunction with the Royal College of Physicians, to ten candidates.

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Section of Ophthalmology: Royal Society of Medicine

THE following are some of the office-bearers for 1920-21. President: James Taylor, C.B.E. Hon. Secretaries: M. L. Hepburn and W. H. McMullen.

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Mr. R. Cross

ON October 8th the portrait of Mr. Richardson Cross (subscribed for by his friends and admirers), was presented to the University of Bristol, with the foundation of which he had been intimately associated.